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Effect of varieties and nutrient levels in rice fallow finger millet on yield, nutrient uptake and soil nutrient status

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Abstract

A field experiment was carried out on clay loam soils during *rabi*, 2024-2025 at Agricultural College Farm, Bapatla to assess the response of finger millet (*Eleusine coracana* L.) varieties to nutrient levels in rice-fallows. The experiment was laid out in randomised block design with factorial concept with 4 varieties viz., Vakula, Tirumala, Indravathi and Gosthani as factor I and nutrient levels – 75%, 100% and 125% RDF as factor II, replicated thrice. The results of the investigation revealed that among the varieties, Indravathi recorded highest grain yield (3148 kg ha⁻¹) compared to other varieties. This variety also recorded higher NPK uptakes and varieties were insignificant regarding post-harvest soil NPK. Application of 125% RDF (75-50-37.5 N, P₂O₅, K₂O kg ha⁻¹) recorded higher grain yield, NPK uptake and post-harvest soil NPK over 100% (60-40-30 N, P₂O₅, K₂O kg ha⁻¹) and 75% RDF (45-30-22.5 N, P₂O₅, K₂O kg ha⁻¹)

Keywords: Rice fallow finger millet, grain yield, NPK uptake, post harvest soil nutrient status

Introduction

Finger millet (*Eleusine coracana* L.) commonly called as ragi in telugu is a vital small millet widely cultivated in India, is a good source of protein (5–8%), ether extractives (1–2%), carbohydrates (65–75%), dietary fibre (15–20%) and minerals (2.5–3.5%). It is an important staple food for people under low socio- economic group. As a C4 plant, it has high water use efficiency and is environmentally sustainable, requiring minimal inputs while still responding well to higher inputs. Additionally, it is known for its exceptional ability to withstand drought conditions making it a best choice for regions where rice cultivation followed by water scarcity. Finger millet (*Eleusine coracana* L.) thrives well as a rice fallow crop due to its exceptional drought tolerance, high water-use efficiency and flexible sowing window. Further, rice fallow finger millet offers numerous economic and sustainability advantages including lower labour, irrigation and fertilizer requirements.

Crop productivity and sustainability largely depend on the selection of suitable varieties and efficient nutrient management practices. Different crop varieties exhibit variations in growth behavior, nutrient absorption efficiency, yield potential, and adaptability to agro-climatic conditions. Simultaneously, balanced nutrient application plays a vital role in improving crop growth, enhancing nutrient uptake, and maintaining soil fertility. The interaction between varieties and nutrient levels significantly influences crop performance, nutrient use efficiency, and soil nutrient dynamics.

In recent years, intensive cultivation and imbalanced fertilizer use have resulted in depletion of essential soil nutrients, leading to declining soil health and reduced crop productivity. Therefore, the adoption of appropriate nutrient management strategies along with high-yielding and nutrient-efficient varieties has become essential for achieving sustainable agricultural production. Nutrient management not only affects crop yield but also influences the availability and residual status of nutrients in the soil after harvest.

Evaluation of crop varieties under varying nutrient levels provides valuable information regarding varietal response, nutrient uptake patterns, and nutrient use efficiency. Such studies help identify suitable combinations of varieties and nutrient management practices that can enhance yield while

maintaining soil nutrient balance. Moreover, understanding the residual effect of nutrient application on soil nutrient status is important for developing sustainable nutrient management strategies.

Therefore, the present study was undertaken to evaluate the effect of different varieties and nutrient levels on yield, nutrient uptake, and soil nutrient status in rice fallow finger millet. The findings of the study may contribute to the development of efficient varietal and nutrient management practices for improving crop productivity and sustaining soil fertility.

Materials and Methods

A field experiment was conducted at Agricultural College Farm, Bapatla, Andhra Pradesh during rabi, 2024-25. The soil of the experimental field was clay loam in texture, neutral in reaction with pH 7.5, electrical conductivity 0.51 dS m⁻¹, non-saline, low in organic carbon, low in available nitrogen (224.2 kg ha⁻¹), medium in available phosphorus (35.1 kg ha⁻¹) and high in available potassium (288.7 kg ha⁻¹). The experiment was laid out in a Factorial Randomized Block Design (FRBD) with 12 treatments replicated three times. Factor I represents varieties i.e., V1: Vakula, V2: Tirumala, V3: Indravathi and V4: Gosthani and Factor II represents nutrient levels i.e., F1: 125%RDF (75-50-37.5 kg NPK ha⁻¹), F2: 100% RDF (60-40-30 kg NPK ha⁻¹), and F3: 75% RDF (45-30-22.5 kg NPK ha⁻¹). NPK were applied in the form of urea, Single Super Phosphate (SSP) and Muriate of Potash (MOP) respectively. Nitrogen was applied in two equal splits viz. basal and 30 DAS and entire dose of phosphorus and potassium was applied as basal. Sowing of seed was done with a spacing of 30 cm x 10 cm on 6th January. Irrigation was given at weekly intervals based on soil moisture conditions. The recommended plant protection measures were followed whenever necessary.

Composite grain and straw samples were taken from the plants collected for dry matter accumulation at harvest and oven dried at 65 °C temperature, grounded into powder using willey mill and passed through 40 mesh sieves. The ground material was used for analysis of NPK contents. The nitrogen content in finger millet plants was estimated by the micro Kjeldahl distillation method (Piper, 1966) [8]. Phosphorus in the di-acid extract of plant samples was estimated by Vanadomolybdo phosphoric yellow colour method using a spectrophotometer at 420 nm wavelength as described by Piper (1966) [8]. Potassium in the di-acid extract of plant samples was determined using a flame photometer as per the method described by Jackson (1973) [3].

The N, P and K nutrient uptake by the crop at harvest, based on nutrient content of plant was calculated by using the following formula and expressed in kg ha⁻¹.

$$\text{Nutrient uptake} = \frac{\text{Nutrient concentration (\%)} \times \text{Weight of drymatter (kg ha}^{-1}\text{)}}{100}$$

The available nitrogen, phosphorus and potassium in the soil was determined by alkaline potassium permanganate method as outlined by Subbiah and Asija (1956) [12], Olsen's method (Olsen *et al.*, 1954) [6] and neutral normal ammonium acetate extractant using a flame photometer (Jackson, 1973) [3] respectively and expressed in kg ha⁻¹.

All the data was analysed statistically following the standard procedures as described by Gomez and Gomez (1984) [2].

Results and Discussion

Grain Yield

Varieties exhibited differential response with regard to seed yield.

Among all the tested varieties maximum grain yield (3148 kg ha⁻¹) was achieved by Indravathi, which was on par with Gosthani (3005 kg ha⁻¹). The lowest yield (2576 kg ha⁻¹) was recorded with Vakula. The varieties outstanding performance could be ascribed to their favourable physiological characteristics and innate genetic potential. Similar results were reported by Sarawale *et al.* (2017) [11], Triveni *et al.* (2018) [14] and Mukesh *et al.* (2024) [4].

Among the different nutrient levels, application of 125% RDF resulted in the highest grain yield (3042 kg ha⁻¹), which was clearly higher than both 100% RDF (2839 kg ha⁻¹) and 75% RDF (2624 kg ha⁻¹). The increased yield with increased fertilizer application might be due to better nutrient availability throughout the crop growth, which might have resulted in more tillering, better grain filling and overall healthier plant development. These results are in agreement with the observations of Rani *et al.* (2023) [9], Sunil *et al.* (2023) [13] and Chandrababha *et al.* (2024) [1].

Grain yield was not affected significantly due to interaction of varieties and nutrient levels in rice fallow finger millet.

Nitrogen uptake

Among the varieties tested, Indravathi recorded the highest nitrogen uptake both in grain (35.0 kg ha⁻¹) and straw (25.0 kg ha⁻¹), which was on par with Gosthani (33.9 and 23.7 kg ha⁻¹ respectively) in both grain and straw and lowest uptake was found with Vakula in both grain and straw (26.2 and 18.8 kg ha⁻¹ respectively).

Nitrogen uptake in both grain and straw increased significantly with higher fertilizer doses. Application of 125% RDF recorded the highest nitrogen uptake (33.8 kg ha⁻¹ in grain and 23.7 kg ha⁻¹ in straw), and the least was observed under 75% RDF (27.8 and 19.7 kg ha⁻¹) in grain and straw. This indicates the positive effect of increased nutrient availability on nitrogen absorption and utilization by the crop. Similar results were reported by Nigade and More (2013) [5], Rani *et al.* (2017) [10], Panda *et al.* (2021) [7] and Sunil *et al.* (2023) [13].

The interaction between varieties and nutrient levels on nitrogen uptake was non-significant.

Phosphorus uptake

Among the varieties, Indravathi showed the highest phosphorus uptake in grain (9.2 kg ha⁻¹) and straw (7.7 kg ha⁻¹), which was on par with Gosthani (8.7 and 7.2 kg ha⁻¹). The variety Vakula recorded the least uptake in both grain and straw (6.8 and 5.9 kg ha⁻¹).

Phosphorus uptake increased with increasing fertilizer levels. The maximum uptake was recorded under 125% RDF (8.8 kg ha⁻¹ in grain and 7.5 kg ha⁻¹ in straw), whereas 75% RDF resulted in the lowest values (7.3 and 6.2 kg ha⁻¹, in grain and straw respectively). The improved P uptake with higher RDF might be due to better availability and mobility of phosphorus in the rhizosphere as per requirement. Similar results were presented by Nigade and More (2013) [5], Rani *et al.* (2017) [10], Panda *et al.* (2021) [7] and Sunil *et al.* (2023) [13].

The interaction between varieties and nutrient levels on phosphorus uptake was non-significant.

Potassium uptake

Among the varieties, Indravathi recorded the highest potassium uptake in grain (24.4 kg ha⁻¹) and straw (88.1 kg ha⁻¹), which was similar to Gosthani (22.8 and 86.4 kg ha⁻¹ in grain and straw respectively) and lowest was observed with Vakula (18.4 and 73.3 kg ha⁻¹) in grain and straw respectively.

Higher fertilizer dose significantly increased potassium uptake. Application of 125% RDF recorded the highest K uptake (23.5 kg

ha⁻¹ in grain and 87.0 kg ha⁻¹ in straw), while the lowest uptake was observed with 75% RDF (19.1 and 75.0 kg ha⁻¹ in grain & straw respectively). This suggests that adequate K availability enhances the crop's ability to assimilate and translocate potassium efficiently to both grain and straw. Similar results were reported by Nigade and More (2013) [5], Rani *et al.* (2017) [10], Panda *et al.* (2021) [7] and Sunil *et al.* (2023) [13].

The interaction between varieties and nutrient levels on potassium uptake was non-significant.

Soil nutrient status

Available nitrogen

The soil available nitrogen after harvest was found non-significant among the varieties. However, the higher available nitrogen was recorded in Indravathi (210 kg ha⁻¹) followed by Gosthani, Tirumala and Vakula (197, 190 and 180 kg ha⁻¹) respectively.

After harvest of the crop the soil available nitrogen was more with increased levels of nitrogen. The higher soil available nitrogen (219 kg ha⁻¹) was recorded with the highest level of fertilizer application is the 125% RDF which was significantly superior over 100% RDF and 75% RDF (195 and 169 kg ha⁻¹), respectively.

Available nitrogen in soil after harvest of finger millet was not affected significantly due to interaction of varieties and nutrient levels.

Available phosphorus

The soil available phosphorus after harvest was found non-significant in varieties. However, the higher available phosphorus was recorded in Indravathi (45 kg ha⁻¹) followed by Gosthani, Tirumala and Vakula (44, 43 and 42 kg ha⁻¹ respectively).

After harvest of the crop the soil available phosphorus was more with increased levels of phosphorus application. The higher soil available phosphorus (50 kg ha⁻¹) was recorded with the highest level of fertilizer application *i.e.*, 125% RDF which was significantly superior over 100% RDF and 75% RDF (44 and 36 kg ha⁻¹, respectively).

Available phosphorus in soil after harvest of finger millet was not affected significantly due to interaction of varieties and nutrient levels.

Available potassium

The soil available potassium after harvest was found non-significant in varieties. However, the higher available potassium was recorded in Indravathi (197 kg ha⁻¹) followed by Gosthani, Tirumala and Vakula (189, 183 and 182 kg ha⁻¹ respectively).

After harvest of the crop the soil available potassium was more with increased levels of potassium application. The higher soil available potassium (196 kg ha⁻¹) was recorded with the highest level of fertilizer application *i.e.*, 125% RDF which was significantly superior over 100% RDF and 75% RDF (187 and 179 kg ha⁻¹) respectively.

Available potassium in soil after harvest of finger millet was not affected significantly due to interaction of varieties and nutrient levels.

Table 1: Nutrient uptake in finger millet as influenced by varieties and nutrient levels in rice fallows

Treatments	Yield (kg ha ⁻¹)	Nutrient uptake (kg ha ⁻¹)					
		Nitrogen		Phosphorus		Potassium	
		Grain	Straw	Grain	Straw	Grain	Straw
Varieties							
V ₁ : Vakula	2576	26.2	18.8	6.8	5.9	18.4	73.3
V ₂ : Tirumala	2612	28.2	19.3	7.4	6.4	19.6	76.2
V ₃ : Indravathi	3148	35.0	25.0	9.2	7.7	24.4	88.1
V ₄ : Gosthani	3005	33.9	23.7	8.7	7.2	22.8	86.4
SEm (±)	76.1	1.04	0.73	0.23	0.20	0.75	2.23
CD (P=0.05)	228.3	3.14	2.21	0.70	0.60	2.26	6.69
Nutrient levels							
F ₁ - 75% RDF	2624	27.8	19.7	7.3	6.2	19.1	75.0
F ₂ - 100% RDF	2839	30.8	21.7	8.0	6.8	21.3	80.9
F ₃ – 125% RDF	3042	33.8	23.7	8.8	7.5	23.5	87.0
SEm (±)	64.9	0.89	0.63	0.20	0.17	0.64	1.90
CD (P=0.05)	194.7	2.67	1.89	0.60	0.52	1.92	5.70
Interaction							
SEm (±)	134.8	1.85	1.31	0.41	0.36	1.33	3.95
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS
CV (%)	8.2	10.4	10.4	8.9	9.1	10.8	8.4

Table 2: Available Nitrogen, Phosphorus and Potassium after harvest of finger millet as influenced by varieties and nutrient levels in rice fallows

Treatments	Available N (kg ha ⁻¹)	Available P ₂ O ₅ (kg ha ⁻¹)	Available K ₂ O (kg ha ⁻¹)
Varieties			
V ₁ : Vakula	180	42	182
V ₂ : Tirumala	190	43	183
V ₃ : Indravathi	210	45	197
V ₄ : Gosthani	197	44	189
SEm±	9.3	1.8	4.8
CD (P = 0.05)	NS	NS	NS
Nutrient levels			
F ₁ - 75% RDF	169	36	179
F ₂ - 100% RDF	195	44	187
F ₃ - 125% RDF	219	50	196
SEm±	7.7	1.5	2.4
CD (P = 0.05)	23.3	4.6	7.2
Interaction			
SEm±	16.2	3.2	8.3
CD (P= 0.05)	NS	NS	NS
CV (%)	14.4	12.6	7.6

Conclusion

Among the different finger millet varieties tested, Indravathi recorded higher grain yield followed by gosthani, Tirumala and vakula. The same trend was followed for NPK uptake. Varieties did not show any significant effect on post-harvest NPK status. Regarding fertilizer levels, Application of 125% RDF (75-50-37.5 kg NPK ha⁻¹), recorded higher grain yield, higher NPK uptake compared to lower levels. Higher nutrient level of 125% RDF also recorded higher post-harvest soil NPK.

References

- Chandraprabha G, Girepunje B, Rupeshwar, Singh VK, Kumar R. Response of finger millet (*Eleusine coracana* L. Gaertn) varieties to nitrogen levels. International Journal of Advanced Biochemistry Research. 2024;8(8):84-86.

2. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 1st ed. New York: John Wiley & Sons; 1984.
3. Jackson ML. Soil chemical analysis. New Delhi: Prentice Hall of India Private Ltd.; 1973. p. 134-182.
4. Mukesh G, Sairam M, Maitra S, Gaikwad DJ, Anuradha N, Sahoo U, *et al.* Performance evaluation of different finger millet (*Eleusine coracana* L. Gaertn) cultivars for growth, productivity and nutrient quality of grains under hot and subhumid region of Odisha. International Journal of Experimental Research and Review. 2024;39:1-14.
5. Nigade RD, More SM. Performance of finger millet varieties to different levels of fertilizer on yield and soil properties in sub-Montana zone of Maharashtra. International Journal of Agricultural Sciences. 2013;9(1):256-259.
6. Olsen SR, Cole CL, Watanabe FS, Dean DA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. Washington, DC: United States Department of Agriculture; 1954. p. 939.
7. Panda P, Maitra S, Panda SK, Shankar T, Adhikary R, Sairam M, *et al.* Influence of nutrient levels on productivity and nutrient uptake by finger millet (*Eleusine coracana* L. Gaertn) varieties. Crop Research. 2021;56(3-4):128-134.
8. Piper CS. Soil and plant analysis. Bombay: Hans Publishers; 1966. p. 368-369.
9. Rani YS, Triveni U, Anuradha N, Patro TSSK. Effect of nutrient management practices on productivity and quality in finger millet under zero tillage conditions in rice fallows. The Andhra Agriculture Journal. 2023;70(1):117-120.
10. Rani YS, Triveni U, Patro TSSK, Anuradha N. Effect of nutrient management on yield and quality of finger millet (*Eleusine coracana* (L.) Gaertn.). International Journal of Chemical Studies. 2017;5(6):1211-1216.
11. Sarawale PP, Rajemahadik VA, Shendage GB, Kumhar BL, Mote AD. Effect of different establishment methods and varieties on yield, quality and nutrient uptake of kharif finger millet (*Eleusine coracana* (L.) Gaertn.). International Journal of Current Microbiology and Applied Sciences. 2017;6(4):1285-1289.
12. Subbiah BV, Asija CL. A rapid procedure for the estimation of available nitrogen in soils. Current Science. 1956;25:259-260.
13. Sunil CM, Sahana SR, Raveendra HR, Bhagyalakshmi T. Response of finger millet (*Eleusine coracana* L. Gaertn) varieties to different fertilizer levels under Cauvery command area of Karnataka (Zone-6). The Pharma Innovation. 2023;12(10):1174-1177.
14. Triveni U, Rani YS, Patro TSSK, Anuradha N, Divya M. Fertilizer responsiveness of short duration improved finger millet genotypes to different levels of NPK fertilizers. International Journal of Agricultural Sciences. 2018;52(1):97-100.